IFW

OIPE JUN 1 0 2005 PATENT & TRADEMARK OFFICE

UNITED STATES PATENT AND TRADEMARK OFFICE

Application No: 10/804,648 Confirmation No.:

Applicant: Fikret M. Zabtcioglu

Filing Date: March 19, 2004

Title: High Reliability – Parallel Data Transfer Hard Disk Drive.

Group Art Unit: 2652

Examiner:

Attorney Docket No: ZABF 104

June 6, 2005

Bellevue, Washington 98004

Mail Stop: Patent Applications.
COMMISSIONER OF PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

INFORMATION DISCLOSURE STATEMENT UNDER R37 C.F.R. 1.97

In compliance with Applicant's and his attorney's duty of disclosure under 37 CFR 1.56, the Applicant does hereby submit the following Information Disclosure Statement, Form PTO - 1449, and copies of the references listed thereon.

A patent search was manually conducted for the invention described in the above-referenced patent application. In the course of the search, no patents were found for an apparatus that has the same structural features or that operates in the same manner such as the invention listed above. The following twenty-two (27) patents, however, were noted as being of interest and are hereby brought to the Examiner's attention as references AA - AZ. The significance of each listed reference is as follows:

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

AA. (U.S. Patent No. 4,754,353) entitled; Hard disk head positioner assembly, Levy, date of patent: Jun. 28, 1988. A digital storage system of the Winchester or hard disk drive type has a magnetic head positioner within which the arm-positioning body, including the heads, is rotatably mounted about a fixed stator assembly which includes a two-part shaft assembly comprising an aluminum cylindrical sleeve thermally shrink fitted about the central portion of an aluminum shaft having a pair of fixed ends and end portions reduced in diameter relative to the central portion by means of a pair of steel bearing assemblies attaching circumferentially about the sleeve in regions exclusive of the shrink fitted central portion of the shaft assembly. The clearance thus provided between the shaft and the mounting sleeve in the regions of the bearing assembly attachment permits a degree of decoupling of mechanical resonances potentially introduced into the head position servocontrol loop by mounting stresses acting upon the shaft.

AB. (U.S. Patent No. 4,879,617) entitled; Actuator assembly for hard disk drives, Sampietro et al, date of patent: Nov. 7, 1989. An actuator assembly for a disk drive system includes an actuator pivotally mounted to a shaft, and a coil assembly. A counterbalance portion of the actuator provides a recess wherein a portion of the coil assembly is slidably inserted. The coil assembly includes a bobbin which has a dovetail portion having at least two precision positioning surfaces which, when placed within the counterbalance recess, interact with corresponding precision positioning surfaces provided within the counterbalance recess. In order to accurately position the coil assembly with respect to the actuator, an outward force is applied to the coil assembly perpendicular to the pivot axis to cause facing pairs of the precision positioning surfaces of the coil assembly and the counterbalance recess to bear against one another, and align a dowel/pin alignment passageway extending through

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

the counterbalance with a dowel/pin recess provided in the bobbin. A dowel is then placed through the alignment passageway and into the dowel/pin recess to hold the actuator and coil assembly in the preferred configuration while an adhesive is injected into the spacing between the bobbin and the counterbalance recess. No adhesive is injected between the precision positioning surfaces bearing against one another. The dowel is subsequently removed and replaced by a stop pin.

AC. U.S. Patent No. 4,949,201) entitled; Disk drive head position controller with static bias compensation and plural velocity detectors, Abed, date of patent: Aug.14, 1990. A positioning system for a hard disk drive for rapidly and accurately positioning the disk head. A constant bias compensation signal is injected into the feedback loop to reduce positioning delays otherwise caused by a steady state force which is asserted against the head. High and low velocity measuring techniques are also disclosed, along with several techniques for advantageously injecting these measurements into the feedback loop at appropriate times. An improved resonant filter is also disclosed.

AD . From(U.S. Patent No. 4,954,904) entitled; Method and apparatus for preventing head crashes in a disk system, Goor, date of patent: Sept. 4, 1990. Improved apparatus and a method are disclosed for controlling the flying height of a head over a rotating medium, such as used in a rigid disk drive employing magnetic, magneto-optic or optical recording techniques. The flying height is controlled via magnetic attraction or repulsion to maintain a selected and substantially uniform flying height of the head with respect to the rotating medium

AE. From (U.S. Patent No. 5,343,347) entitled; Magnetic disk storage module with multiple sets of actuator arms for simultaneous read/write operations at different

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

circumferential locations within the disk stack, Gilovich, date of patent: Aug. 30, 1994. A hard disk drive module for providing memory storage for a computer includes a centrally positioned rotatable stack of disks and a plurality of rotary actuator arms mounting magnetic heads for movement radially of the disks to read/write magnetically encoded data on each surface thereof. The actuator arms which extend between adjacent spaced disks are provided by plural-arm assemblies individually pivotally mounted at each of the four corners of the module so that the radial tracking movement of the heads thereon occurs in angularly spaced locations in the disk stack. Each actuator assembly is driven by a drive arm extending at an acute angle with the longitudinal axes of the associated actuator arms so as to minimize the required space on the module for the drive elements.

AF . From (U.S. Patent No. 5,675,452) entitled; Thin data storage device having a flexible recordable disk and recording heads arranged on both sides of the disk, Nigam, date of patent: Oct. 7, 1997. In one embodiment, the invention provides a thin data storage device comprising a housing that has a top and a bottom cover and a printed circuit board having electronic integrated circuits mounted thereon. A rotatable spindle is formed about a cylindrical shaft and is rotatable by rotation means. A magnet structure is rigidly mounted to a flange attached to the spindle. A stator is attached to the circuit board and comprises plates of soft magnetic material having coils wrapped on legs of the stator. At least one flexible recordable disk is non-removably mounted to the spindle. A top and a bottom recording head is arranged on both sides of the disk. A woven liner is attached to the top of the circuit board over the integrated circuits. A rotor is arranged on a second shaft at a point displaced from the first shaft. The rotor is rotatable by a second rotation means configured to allow the rotor to move relative to the disk. A coil of wire is attached to one side of the rotor and is displaced

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

in a magnetic field developed between a magnet structure mounted to a first soft magnetic plate that is attached to the bottom cover and a second soft magnetic plate that is attached to the top cover. A flexible printed circuit cable is attached to the circuit board and the rotor to provide a path for electrical servo control and recording signals between the rotor coil, recording heads and the circuit board.

AG. From (U.S. Patent No. 5,761,007) entitled; Disk drive with multiple actuators on a single axis having different inertia characteristics, Price et al, date of patent: Jun. 2, 1998. Disclosed is a data recording disk file having multiple actuators mounted on a common pivot axis, one of the actuators having fewer arms and lower inertia characteristics than the other. A servo system separately drives each of the actuators for seek repositioning, the lower inertia actuator having a higher performance than the other. A controller selectively records one type of data on the data surfaces associated with the lower inertia actuator, and records all other data on the other data surfaces, thereby providing a disk drive with increased performance appropriate to the data stored on the surfaces associated with the lower inertia actuator. A removable locking pin may be provided which extends through corresponding holes in each of the actuators for maintaining the actuators precisely positioned with respect to each other so that servo information may be written on each of the surfaces in a single process. Additionally, one of the actuators may be provided with a shorter stroke than the other actuators. Further, the tracks of the data surfaces associated with one of the actuators may have a different track pitch than the other data surfaces.

AH. From (U.S. Patent No. 5,836,205) entitled; Linear actuator mechanism, Meyer, date of patent: Nov. 17, 1998. A linear actuator has four drive gears which engage two racks. The actuator movable member may comprise two racks which have gear teeth which

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

face inwardly and towards each other, or a single rack which has gear teeth which faces outwardly. In either case, four gear drives to engage the rack, two gear drives on each side. A plurality of linear actuators may be used to provide for position control in two or more directions. Control is provided by a servo mechanism.

AI. (U.S. Patent No. 5,796,542) entitled; Servo-track writer system having a plurality of engaging pins co-axially rotated with head actuator pivot axes, Szeremeta, date of patent: Aug. 18, 1998. An apparatus and method useful in a servo-track writer (STW) system for simultaneous servowriting of tracks on disk surfaces in a plurality of disk drive head assemblies (HDAs). The STW system includes a motor disposed to turn a drive shaft on a shaft axis. The drive shaft is supported in a base air bearing and coupled to a rotatable elongated push-tower apparatus such that shaft rotation causes rotation of the push-tower apparatus on a STW bearing axis disposed coaxially with the shaft axis. The push-tower apparatus includes an externally-fixed retroreflector displacement sensor and a plurality of fixed HDA actuator arm engaging pins each disposed to engage one of a plurality of HDAs mounted in alignment in a stationary HDA positioning apparatus. Push-tower rotation moves each engaging pin into contact with a respective HDA actuator arm, moving the actuator arm to a position that is determined by processing position information feedback from the push-tower retroreflector displacement sensor. The rotatable push-tower apparatus is supported at the end opposite the base air bearing by a self-aligning distal air bearing. The invention coaxially aligns each HDA actuator arm pivot axis with the STW bearing axis and the respective engaging pin axis to reduce head-positioning errors caused by retroreflector sensor transmission error and supports the distal push-tower shaft with a self-aligning air bearing to reduce head-positioning errors caused by friction noise.

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

AJ. U.S. Patent No. 5,706,148) entitled; Hard disk drive with kinematically mounted disk platters, Faris, date of patent: Jan. 6,1998. A disk drive system (50) comprising a spindle (52) having a circular outer perimeter (60) and an axis of rotation. The spindle comprises a first boss (68), a second boss (70), and a third boss (72), each of which is spaced around the circular outer perimeter of the spindle. Moreover, each of the bosses has an upper support surface (68a, 70a, 72a). Lastly, the disk drive system comprises a disk (8b) abutted to each of the upper support surfaces of each of the first, second, and third bosses.

AK. From (U.S. Patent No. 5,949,612) entitled; Low friction sliding hard disk drive system, Gudeman et al, Sept. 7, 1999. A operationally contacting hard disk drive system has reduced friction due to lower capillary adhesion between the disk surface and a transducer in a substantially continuous sliding relationship with the surface. The disk surface has an adhesion-reducing texture that includes a microscopic RMS roughness in a range between about 1.5 and 5.5 nanometers, or a number of asperities having a mean plane to peak height in a range between about 6 and 50 nanometers. The roughness may increase in a radially graded fashion to compensate for the increased linear velocity and concomitant frictional power loss near the outer diameter of the disk. It is important that the uppermost reaches of the textured surface are smooth but not flat in order to obtain lasting low friction operation, which is accomplished by constructing the surface with a highest approximately one percent having an average radius of curvature in a range between 2 microns and 100 microns. An area of the slider in apparent contact with the disk surface is preferably less than 1000 square microns, and a ratio between this nominal area and the mean to peak height is less than 0.3 meters. The slider may also include a substantial thickness of partially wetting material in contact with the disk, or may alternatively be textured with deep grooves or materials having

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

differing wear rates, in order to provide reduced frictional adhesion despite wear of the slider.

AL. From (U.S. Patent No.6,005,747) entitled; High capacity disk drive with two stator windings, Gilovich, date of patent: Dec. 21, 1999. A hard disk drive apparatus is disclosed which utilizes at least a pair of actuator assemblies each of which includes a plurality of separate actuator arms and spacers stacked on a tubular sleeve which is bearing on a stationary actuator shaft. The arms and spacers are preferably ceramic with head leads and preamplifiers carried on the arm. Each actuator stack has heads oriented in one direction to minimize the spacing between the hard disks.

AM. From (U.S. Patent No. 6,252,743) entitled; Read/write positioning arm with interspaced amplifier chips, Bozorgi, date of patent: June 26, 2001. Amplifier chips for heads in a disk drive are interspaced adjacent to junctions between actuator arms and suspension arms that hold the heads. This allows decreased spacing between plural disks in the drive system and accelerated data rates. This also decreases assembly steps and damage to the chips as they are further removed from mechanical processes such as swaging that attach the suspension arms to the actuator arms. Damage to the disks or chips during operation is also averted, as the chips are removed from each other and from the rapidly spinning disk surfaces with which the suspension arms and heads are proximate. The interspacing can also improve performance characteristics of the preamplifier chips, which do not need to be made as thin in order to fit between disks, decreasing costs and problems such as overheating of the chips.

AN. From (U.S. Patent No. 6,633,457) entitled; Actuator assembly with orthogonal force generation, Lin et al, date of patent: Oct 14, 2003. An actuator assembly for positioning read/write heads above a data storage media comprises a pivotally mounted

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

carriage arm assembly with a voice coil and a magnetic device having a plurality of poles for generating a magnetic field. The voice coil is positioned with its effective portions crossing through the magnetic field to generate at least one pair of driving forces in a direction substantially orthogonal to a seeking direction of the read/write heads. The carriage arm driven by said pair of forces has substantially no reacting force generated onto the pivot so that the servo bandwidth of the head positioning assembly can be improved and achieves a high degree of head positioning accuracy.

AO. From (U.S. Patent No. 6,633,458) entitled; Rotary piezoelectric micro actuator with an optimum suspension arrangement, Wu et al, date of patent: Oct 14, 2003. The invention relates to a microactuator comprising a movable structure having a symmetric axis about which the movable structure are divided into two parts which can produce the same movement but in opposite directions; two active arms built with piezoelectric material; two stationary structures to connect the two active arms at their two ends, respectively. The invention also relates to a disk drive suspension which is incorporated with the microactuator.

AP. From (U.S. Patent No. 6,611,396) entitled; Disk level servo write, Kermiche et al, date of patent: Aug. 26, 2003. A method for assembling and operating a fixed media hard disk drive using a disk or a stack of disks on which servo information is pre-written off the drive spindle. The disks are subsequently mounted on the drive spindle and a set of rotationally concentric "virtual tracks" for seeking and following in terms of said pre-written servo tracks are defined. The use of the concentric virtual tracks assures minimal actuator motion during drive operation and increases acceptable offtrack tolerances. The off-spindle, pre-writing of the servo information increases the efficiency of the assembly operation and

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

reduces the clean room burden.

AQ. From (U.S. Patent No. 6,512,659) entitled; Disk drive actuator arm with micro actuated read/write positioning, Hawwa et al, date of patent: Jan. 28, 2003. The present invention is embodied in an actuator arm which is mounted to a primary actuator. The primary actuator positions the actuator arm, with a read/write head mounted to the actuator arm, across a data storage disk. The actuator arm comprises an inboard portion, an outboard portion and a pair of bimorph actuators. The inboard portion has a longitudinal axis and is attached to the primary actuator. The outboard portion has the read/write head mounted onto it. The pair of bimorph actuators are deflectable together in a common direction and are connected between the inboard and the outboard portions. Upon deflection of the bimorph actuators in the same direction, the outboard portion is translated along an at least nearly straight line transverse to the longitudinal axis of the inboard portion. This transverse motion allows the read/write head to be kept substantially within a plane parallel to the surface of the data storage disk, preventing damage caused by possible contact between slider and the disk surface from rolling the slider due to out-of-plane motions. Further, the use of bimorph actuators provide increased displacements of the read/write head. Also, since the head displacement is not a function of microactuator's position along the actuator arm, the actuator arm can be shorter, allowing for use in compact disk drives.

AR. From (U.S. Patent No. 6,618,217) entitled; System and method for determining the position of a device, Heaton et al, date of patent: Sept.9, 2003. A position sensor includes a stationary platform and a moveable platform. The position sensor further includes at least one beam coupling the moveable platform to the stationary platform. The at least one beam includes piezoresistive material that is positioned tolprovide an indication of a

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

movement of the moveable platform relative to the stationary platform

AS. From (U.S. Patent No. 6,594,106) entitled; Adaptive servo estimator and compensator for coil and carriage deformation in voice coil motor driven hard disk drive, Serrano et al, date of patent: Jul. 15, 2003. A system and method for adaptively compensating for real-time variations in mechanical dynamics of a head-positioning assembly during track follow and seek operations. The head-positioning assembly includes a voice coil actuator that positions a read/write head utilizing a coil and carriage in conformity with an actuator control signal. Variations in resonant mode characteristics are anticipated in real-time in accordance with measured temperature variations. These parametric variations are translated in real-time by a state space model to determine a secondary velocity and displacement of the read/write head during track follow and seek operations. In response to this secondary velocity and displacement determination, the actuator control signal is dynamically adjusted to compensate for the determined secondary head velocity and displacement, thereby improving head positioning accuracy and increasing servo bandwidth.

AT. From (U.S. Patent No.6,621,649) entitled; Write-to-read switching improvement for differential preamplifier circuits in hard disk drive systems, Jiang et al, date of patent: Sept. 16, 2003. The present invention relates to a preamplifier circuit comprising a plurality of amplifier stages coupled together and operable to consecutively amplify a signal associated with a head of a hard disk drive. The preamplifier circuit further comprises a power delivery circuit operably coupled to the amplifier stages and operable to provide power to the amplifier stages in a substantially concurrent manner when the hard disk drive is transitioning from a write state to a read state. In addition, the circuit comprises a control circuit operably coupled to the amplifier stages, and operable to activate at least two of the plurality of

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

amplifier stages in a generally consecutive manner after the providing of power to the amplifier stages. In the above manner a saturation of an output of the preamplifier circuit is avoided by preventing substantially a propagation of glitches through the preamplifier circuit and providing for a substantially fast write-to-read transition time.

AU. From (U.S. Patent No. 6,661,593) entitled; Servo information detection method and disk apparatus using the same, Ashikaga et al, date of patent: Dec. 9, 2003. In a servo information detection method and disk apparatus of the present invention, it is determined whether a pattern of detection bits, detected from a vicinity of a servo sync mark of a disk, matches with a given comparison bit pattern. A pattern of tolerance bits is changed based on a location of the disk where the servo sync mark is detected, so that the matching between the detection bit pattern and the comparison bit pattern is performed based on the changed tolerance bit pattern.

AV. From (U.S. Patent No. 6,611,401) entitled; Glide head with a transverse contact rail, Burga et al, date of patent: Aug. 26, 2003. A glide head includes two rails that run from the leading end to the trailing end of the glide head and a transverse contact rail that is orientated orthogonally to the two rails and is located at the trailing end of the glide head. The two rails may contact the transverse contact rail or one or both may not extend to the transverse contact rail. In addition, the channel region defined between the two rails and the wing, if used, may be tapered so that they merge with the bottom surface of the transverse contact rail. The transverse contact rail may extend beyond the two rails. The glide head flies with a positive pitch which causes the transverse contact rail to be the closest area on the glide head to the surface of a rotating disk being tested. Thus, the mechanical energy is greatest when the transverse contact rail contacts a defect on a disk, and thus the transverse

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

contact rail is the active rail. Because the transverse contact rail extends across the width of the glide head, the glide head may be stepped by large amounts when testing a disk, which decreases testing time and increases throughput. In addition, the transverse contact rail may extend from one side of the glide head to the other, and thus, the glide head may be used to test both the inside diameter and outside diameter of a disk.

AW. From (U.S. Patent No. 6,624,981) entitled; Micrometric actuation, hard disk read/write unit with a flexure and micro actuator formed in a monolithic body of semiconductor material, Vigna, date of patent: Sept. 23, 2003. A hard disk read/write unit is formed in a monolithic body of semiconductor material, including a suspension structure, a coupling or flexure element integral with the suspension structure, and a microactuator, integral with the coupling. The monolithic body has a first portion accommodating integrated electronic components, and a second portion, accommodating the coupling and the microactuator. The coupling is formed from a central region, accommodating the microactuator; an annular region, separated from the central region by a first trench, and from the suspension by a second trench; a first pair of suspension arms, extending between the central region and the annular region, along a first axis; and a second pair of suspension arms, extending between the annular region and the suspension structure, along a second axis perpendicular to the first axis. The first and second pair of arms, with a reduced thickness, impart to the coupling yielding for rotations around the first and second axes of the central region.

AX. From (U.S. Patent No. 6,633,458) entitled; Rotary piezoelectric micro actuator with an optimum suspension arrangement, Wu et al, date of patent: Oct 14, 2003. The invention relates to a microactuator comprising a movable structure having a symmetric axis

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

about which the movable structure are divided into two parts which can produce the same movement but in opposite directions; two active arms built with piezoelectric material; two stationary structures to connect the two active arms at their two ends, respectively. The invention also relates to a disk drive suspension which is incorporated with the microactuator.

AY. From (U.S. Patent No.6,532,137) entitled; Head assembly, disk drive apparatus, hard disk drive and method for manufacturing disk drive apparatus, Huang et al, date of patent: Mar. 11, 2003. A disk drive head assembly enables adjustment of a center of gravity of the head assembly of a depopulation version, while suppressing an occurrence of a resonance frequency affecting the performance of the disk drive apparatus. The head assembly for the data storage media includes: magnetic heads for reading/writing data from/to the data storage media, arms to which the magnetic heads are attached, a pivot shaft holder for supporting the arms, a coil for a voice coil motor extended from the pivot shaft holder, and a counter weight provided at a predetermined position opposite to a coil for the voice coil motor with respect to the pivot shaft holder.

AZ. From (U.S. Patent No. 6,655,002) entitled; Micro actuator for use in mass data storage, or the like, and method for making same, Maimone et al, date of patent: Dec. 2, 2003. A microactuator, or micromotor, (60) and method for making it are presented such that a symmetrical build up of material is performed on opposite sides of a substrate. This reduces mechanical stresses in the device. In its construction, respective layers of circuit portions (108, 110) are built on each side of the structure, thereby eliminating the need to stack complex patterns. Stacking one complex pattern on top of a similar pattern is difficult because the surface, which is the base for subsequent layers, is not flat. The photolithography

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

process that forms these patterns is not very forgiving to non-flat surfaces. Avoiding the stacked layers also allows thicker conductors to be considered for each circuit. Thicker circuits increase current carrying capacity, which in one of the key variables increase the power of the micromotor.

BA. From (U.S. Patent No. 6,674,598) entitled; Radial positioning of data to improve hard disk drive reliability, Smith, date of patent: Jan 6. 2004. To optimize the life of a magnetic disk data storage device it is recognized that the accessing of data on the disk data surface should mimic the varying effective lubricant protection over the disk surface. The lubricant applied to the disk data surfaces migrates outward during drive operation. To match the disk surface protection to the frequency of data accesses at the storage locations, the stored data files are periodically examined to determine how recently access has occurred and the number of accesses during a most recent fixed period to determine whether the data file is to be stored in radially inner or radially outer portions of the band of concentric data tracks. By thus allocating the data file storage location, the data is accessed and intermittent contact between disk surface and transducer carrying slider occurs with greatest frequency where the lubricant coating is least depleted and most robust.

The Applicant and his attorney submit that the above-cited references taken alone or in combination neither anticipate nor render obvious the present invention. None of the references disclose or claim a hard disk drive system made of at least two pairs of actuator and suspension arm assembly mechanism and which are operably coupled to multiple read/write heads there-under and there-upon. Where these have concurrent access to two quadrants of the disk platter surface on both upper and lower sides of the platters and are moveable on two linear paths (as opposed to the prior art single one curved path) by the voice

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

coil motors (as opposed to the prior art single one curved path.)

Where the actuators and suspension arm assemblies on the opposite sides, remain parallel to each other at each quarter, but cover different data tracks on each of the other opposite quarter areas of the platter – at that instant of the platter spin point in time. Hence, high speed spin becomes unnecessary. Where the plurality of actuators and suspension assemblies on two opposite sides of said quarters, have considerably higher number of R/W heads fixed there - under which enables to access a multiple set of adjacent data tracks and continuous data sectors – even as the actuator arm assembly remains unmoved for a certain period.

The R/W heads work in coordination; resulting in the minimization of the distance of each actuator and suspension arm assembly stroke distance and hence changing the coordinates of the R/W heads coupled there-under and there-upon, to a substantially shorter distance. This keeps each one of the components – part of the pair actuator and suspension arm within a minimized limited range of back and forth motions.

Said access to a multiple set of data tracks and continuous data sectors is a function of the sum of the larger area of actuator arm and suspension assemblies, that have the R/W heads fixed there-under symmetrically - with equal distances between them. These R/W heads are in conformity to the curve-linear approach angle of the data tracks. (Even as actuator arm remains unmoved for a certain time period.)

The above mentioned feature enables micro-actuation and servo control functions when voice coil motor motion is in the digital mode for precision. It switches to analog mode when data tracks that have to be accessed which are not adjacent and far apart. Switching between digital and analog is frequent as both adjacent and non-adjacent data tracks are

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

reached.

Hence, a set of multiple data tracks reach R/W heads; instead of moving the R/W to a set of adjacent data tracks – data tracks reach the R/W head fixed onto said actuator arm and suspension assembly. Instead of having to move the actuator back and forth to access data tracks for even close proximity and adjacent data tracks, as it is with the prior art.

The RPM of the platter can thereby be kept at lower rates of 5000 RPM and 7500 RPM; as the two pairs of actuators and suspension assemblies enable lower spin rates for the drive to R/W a given amount of data within a shorter time – despite a lower RPM.

Furthermore, said distance of actuator motion is shortened for each one of the actuator and suspension assemblies, relative to the prior art straight arm actuator swings; where the actuator has to cover a longer distance between the outer most data tracks and inner most data tracks, and which is limited to only a few R/W heads fixed thereon as a consequence of the geometric shape of the straight arm actuator.

Therefore, the space needed for the voice coil motors is approximately one half of the voice coil motor space needed of a prior art multiple straight arm actuator – as a function of the considerably shortened distance of the minimized range motions of the actuator and suspension assemblies of this invention.

The concurrent full stroke access to multiple data tracks and uninterrupted data sectors enables a substantial shortening in seek - read and write times and makes it instantaneous.

Invention system also provides simultaneous access to a set of multiple data tracks and enable continuity of accessing data sectors without interruption of the R/W functions and thereby enables parallel data transfer capability.

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035

Furthermore, the parking function is made more reliable by avoiding R/W head landing; as one continuous contact micro – pad(s) per two R/W heads are utilized to keep the micro distance of the R/W heads constant and thereby avoid head ding and physical contact with the platter surface, when read/write heads are in the parking mode.

The listed references relate only to the general field of the disclosure and do not constitute an admission that the references are relevant or material to the claims; they are cited only as constituting the closest art of which the Applicant and his attorney are aware.

The listed references relate only to the general field of the disclosure and do not constitute an admission that the references are relevant or material to the claims; they are cited only as constituting the closest art of which the Applicant and his attorney are aware.

Respectfully submitted,

DEAN A. CRAINE

Reg. No. 33,591, Attorney for Applicant

Cc. Fikret M. Zabtcioglu (Sole inventor.)

DEAN A. CRAINE, P.S.
400 - 112th Ave. N.E., Ste. 140
Bellevue, WA 98004
(425) 637-3035